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IS 2243 (1971): Drill Chucks [PGD 2: Machine Tool Elements and Holding Devices]

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Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

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UDC 621·952-229·323
(Third Reprint FEBRUARY 1990)
IS : 2243 - 1971
(Reaffirmed 2001)

Indian Standard

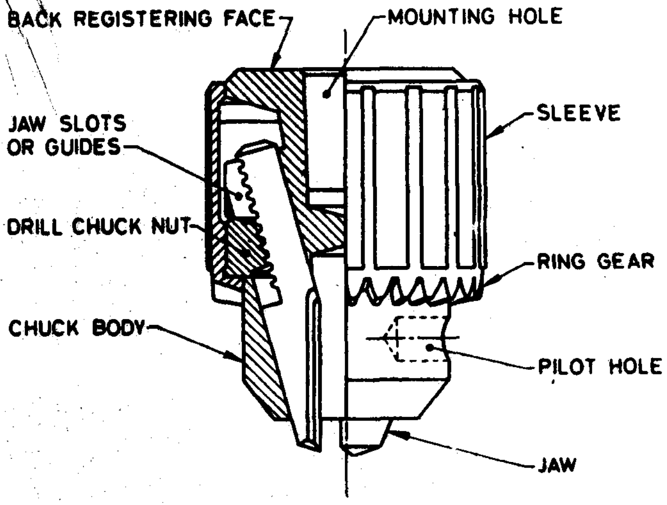
SPECIFICATION FOR DRILL CHUCKS

(*First Revision*)

1. Scope — Sizes, mounting details and accuracy requirements for drill chucks for use in machine tools and portable power tools.

1.1 This standard does not cover the types of chucks fitted to carpenters' and blacksmiths' tool chucks.

2. Nomenclature and Terminology



2.1 *Chuck Body* — Part of a drill chuck which encloses the operating mechanism and also carries the jaws.

2.2 *Sleeve* — Part of a drill chuck which fits over the body. It may have bevel teeth cut on one rim; if so, the sleeve actuates the jaws through a nut.

2.3 *Ring Gear* — A ring of bevel teeth which engage with the pinion on the drill chuck key. It may have internal taper threads which actuate the jaw along the jaw slots or along the guides in the body of the drill chucks, in which case it combines the functions of ring gear and drill chuck nuts.

2.4 *Drill Chuck Nut* — Part of a drill chuck which is between the body and the sleeve. It has internal taper threads which actuate the jaw along the jaw slots or along the guides in the body of the drill chucks.

2.5 *Jaws* — Members, three in number, formed to fit the jaw slots or guides in the drill chuck body to grip the drill or other cutting tools.

2.6 *Jaw Slots or Guides* — Slots in the body of the drill chuck along which the jaws are guided by means of a key.

2.7 *Pilot Holes* — Holes in the body of the drill chuck, usually three in number, which receive the pilot or the extended part of the pinion on the drill chuck key.

2.8 *Mounting Hole* — Taper hole at the back of the body of the drill chuck for an arbor or spindle for mounting on the machine.

2.9 *Back Registering Face* — Face against which the face of the arbor makes contact when the chuck is mounted on the machine spindle.

Machine Tools, Machine Tool Elements and Woodworking Machines Sectional Committee, EDC 11 [Ref : Doc : EDC 11 (1741)]

Adopted 15 September 1971	© June 1972, BIS	Gr 6

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

3. Types

Type L — Guided 3-jaw light duty chuck,
Type H — Guided 3-jaw industrial or heavy duty chuck, and
Type S — Guided 3-jaw industrial self-tightening (keyless) chuck.

3.1 *Guided 3-Jaw Light Duty Chucks, Type L (see Fig. 1)* — In this type of chuck, the 3 jaws which grip the shank of a drill operate in guides in the chuck body. The chuck is tightened and untightened by means of a geared key and, though suitable for any light duty application, is mainly used with light duty portable power tools.

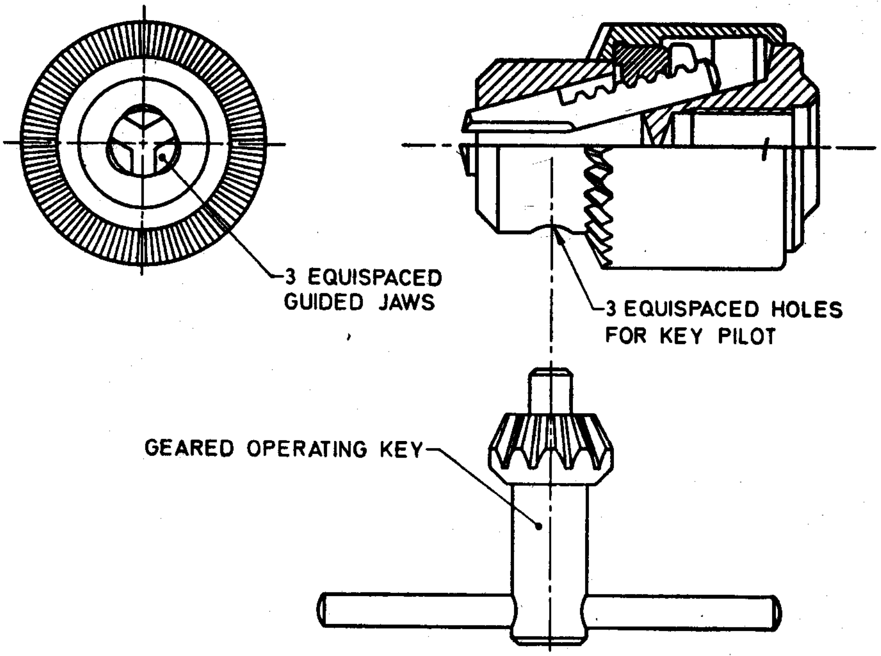


FIG. 1 A TYPICAL GUIDED 3-JAW LIGHT DUTY CHUCK

3.2 *Guided 3-Jaw Industrial or Heavy Duty Chucks, Type H (see Fig. 2)* — In this type of chuck also, the 3 jaws which grip the shank of a drill operate in guides in the chuck body and the chuck is tightened and untightened by means of a geared key. It is capable of transmitting higher torque loads than the light duty chuck and is suitable for use with machine tools and medium duty and heavy duty portable power tools.

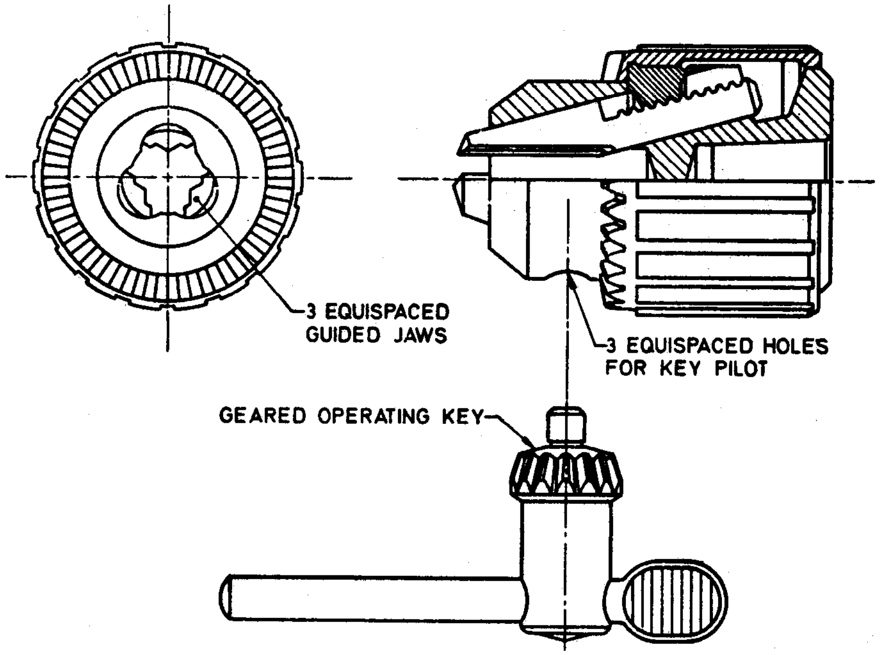


FIG. 2 A TYPICAL GUIDED 3-JAW INDUSTRIAL OR HEAVY DUTY CHUCK

3.3 *Guided 3-Jaw Industrial Self-Tightening (Keyless) Chucks, Type S (see Fig. 3)* — In this type of chuck also, the 3 jaws which grip the shank of a drill operate in guides in the chuck body. The chuck after hand-tightening operates without any auxiliary tightening mechanism. As the chuck is designed to self-tighten under increased drilling torque, a gripping collar is usually fitted to assist untightening.

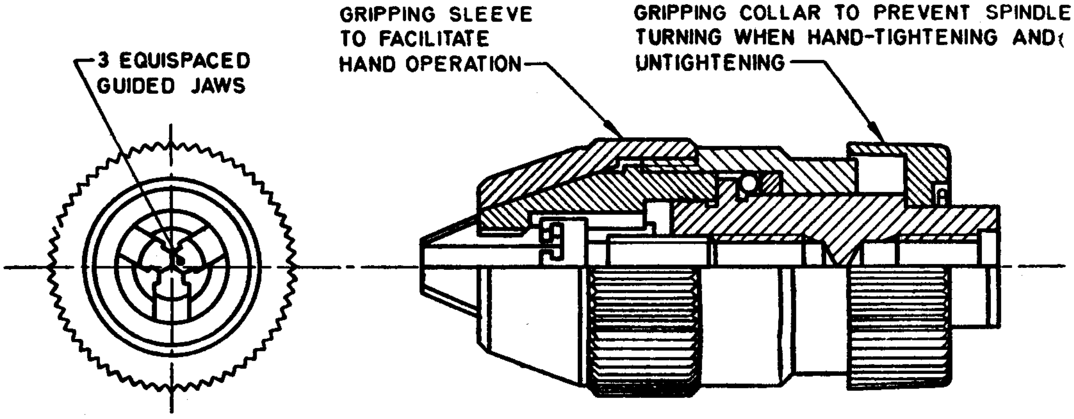
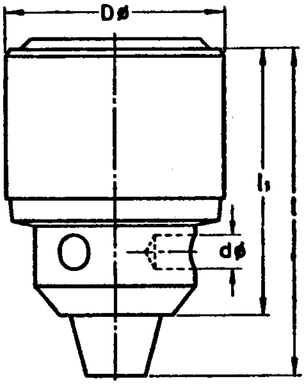

3 EQUISPACED GUIDED JAWS
GRIPPING SLEEVE TO FACILITATE HAND OPERATION
GRIPPING COLLAR TO PREVENT SPINDLE TURNING WHEN HAND-TIGHTENING AND UNTIGHTENING

FIG. 3 A TYPICAL GUIDED 3-JAW INDUSTRIAL SELF-TIGHTENING (KEYLESS) CHUCK

4. Dimensions

4.1 *Overall Dimensions of Gear Type Chucks*



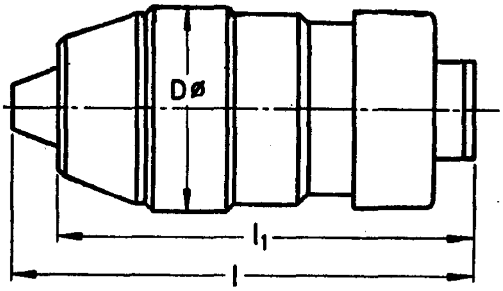
All dimensions in millimetres.

Nominal Size	Range of Holding Capacity		*D* *Max*	Length of Chuck When Jaw is Closed *l* *Max*	Length of Chuck When Jaw is Open *l*₁ *Max*	*d* H9	
	Type L	Type H				Type L	Type H
4	0-4	0-4	30·0	51·0	41	3·9	5·5
6	0-6·5	0-6·5	34·0	56·0	45	3·9	5·5
8	0-8	0-8	37·0	61·0	48	6·0	6·0
10	1·5-10	1·5-10	46·0	76·0	59	6·3	6·3
13	1·5-13	2-13	52·0	89·0	70	7·9	7·9
16	3-16	3-16	59·0	97·0	73	7·9	7·9
20	—	5-20	65·0	105·0	82	9·5	9·5

Note — ' Capacity 0 ' means that the chuck will firmly grip a 0·7 mm drill except that a 0-4 mm chuck will firmly grip a 0·35 mm drill.

4.1.1 The number of teeth on the ring gear shall be 26 to 36 and that on the key pinion shall be 10 to 12 depending on the size of the drill chuck. All other design details of the ring gear and key pinion are left to the manufacturers (*see also* **7**). For the sake of information, the overall dimensions of the drill chuck key are given in Appendix A.

4.2 *Overall Dimensions of Guided 3-Jaw Industrial Self-Tightening (Keyless) Chucks*



All dimensions in millimetres.

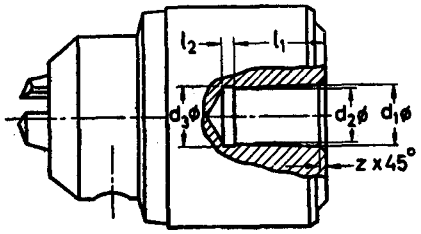
Nominal Size	Range of Holding Capacity	*D* *Max*	Length of Chuck When Jaw is Closed *l* *Max*	Length of Chuck When Jaw is Open l_1 *Max*
4	0-4	30·0	62	56
6	0-6	34·0	68	62
8	0-8	37·0	78	69
10	0-10	43·0	92	80
13	0·8-13	50·0	103	91
16	3-16	56·5	109	95

Note — 'Capacity 0' means that the chuck will firmly grip a 0·7 mm drill except that a 0-4 mm chuck will firmly grip a 0·35 mm drill.

4.3 *Dimensions of Mounting Hole of Chucks*

Note — Dimensions of spindle ends to receive the chucks are given in Appendix B for information.

4.3.1 *Short Morse taper bores in chucks*



All dimensions in millimetres.

Designation of Taper*	d_1† N9	d_2‡	d_3	l_1	l_2	z	Taper	
							Morse Taper	On Diameter
B10	10·094	9·441	9·8	13·11	3·5	1·0	1	0·049 88
B12	12·065	11·214	11·5	17·07	3·5	1·0		
B16	15·733	14·602	15·0	22·63	3·5	1·5	2	0·049 95
B18	17·780	16·253	16·8	30·56	3·5	1·5		
B22	21·793	19·901	20·5	37·69	3·5	2·0	3	0·050 20
B24	23·825	21·395	22·0	48·41	3·5	2·0		

*The tapered portions are identical with:

Morse taper 1 for tapers B10 and B12,

Morse taper 2 for tapers B16 and B18, and

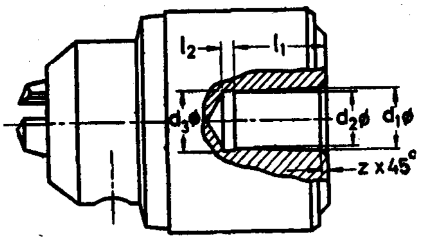
Morse taper 3 for tapers B22 and B24.

The length of each of these tapers is, of course, distinctly less than the overall length of corresponding Morse tapers; each taper may be regarded as corresponding approximately either to that part of the Morse taper nearest the small end (for example B10) or to the part nearest the large end (for example B12).

†The gauge plane diameter d_1 is the diameter at the wide end of the taper bore before chamfering.

‡Calculated values of d_2 are given for information.

4.3.2 *Jacobs taper bores in chucks*



All dimensions in millimetres.

Jacobs Taper*	d_1† N9	d_2‡	d_3	l_1	l_2	z	Taper on Diameter
0	6·350	5·880	§	9·52	§	0·5	0·049 28
1	9·754	8·590	8·92	15·08	3·17	1·0	0·077 09
2 short	13·940	12·515	12·83	17·46	3·17	1·0	0·081 55
2	14·199	12·515	13·08	20·64	3·17	1·0	0·081 55
33	15·850	14·338	14·66	23·81	3·17	1·5	0·063 49
6	17·170	15·933	16·26	23·81	3·17	1·5	0·051 91
3	20·599	19·078	19·30	28·57	4·76	2·0	0·053 25
4	28·550	26·471	27·10	39·67	4·76	2·5	0·052 40
5	35·890	33·300	34·49	50·01	4·76	3·0	0·051 83

*The tapered portions are the normal Jacobs tapers and the designations, in spite of their illogical appearance, are the generally accepted designations. In effect, the range of increasing values for d_1 contains two tapers, the first of which is a short taper 2, and between the tapers 2 and 3, there are two interpolated tapers which bear the out-of-series numbers 33 and 6 respectively.

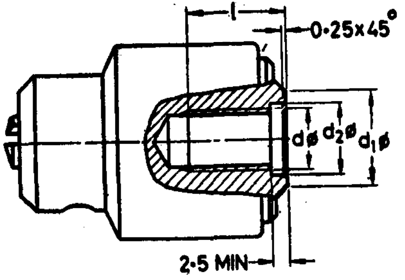
Details of Jacobs No. 4 and 5 tapers are given for information but these tapers shall be avoided wherever possible.

†The gauge plane diameter d_1 is the diameter at the wide end of the taper bore before chamfering.

‡Calculated values of d_2 are given for information.

§The Jacobs No. 0 taper bore is not normally recessed.

4.3.3 *Internal thread in chuck body*



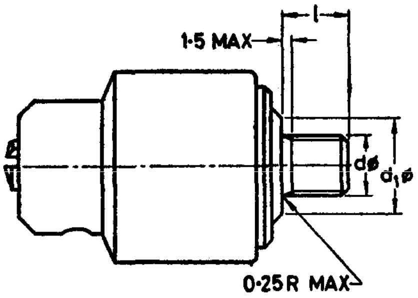
All dimensions in millimetres.

d	d_1 $^{+0}_{-0·4}$	d_2 $^{+0·15}_{-0}$	l Min
M10 × 1	16	12	16
M12 × 1·25	22	14	16
M14 × 1·5	30	16	20
M18 × 1·5	33	20	20

Note 1 — The abutment face on chuck body shall be flat to concave within 0·04 mm across the diameter d_1 and shall be square to the axis of the threads

Note 2 — The counterbore d_2 in the chuck body is intended for clearance purposes only and shall not be used as a register.

4.3.4 *External thread on chuck body*



All dimensions in millimetres.

d	d_1	*l* *Max*
M10 × 1	16	11
M12 × 1·25	22	14

Note — The abutment face on chuck body shall be flat to concave within 0·04 mm across the diameter d_1 and shall be square to the axis of the threads.

5. Designation — A chuck of light duty type and of nominal size 6 having Morse taper B10 shall be designated as:

Drill Chuck L6 B10 IS : 2243

A chuck of heavy duty type and of nominal size 10 having internal threads M12 shall be designated as:

Drill Chuck H10 M12 IS : 2243

A chuck of heavy duty type and of nominal size 10 having external threads M18 shall be designated as:

Drill Chuck H10 M18 *ext* IS : 2243

A self-tightening type of drill chuck of nominal size 16 shall be designated as:

Drill Chuck S16 IS : 2243

6. Material and Manufacture — Drill chucks shall be made from suitable grade of steel and shall be designed to withstand the stresses to which such chucks are usually subjected. The jaws shall be of suitable grade wear resistant steel, properly heat-treated to give a hardness of 55 to 60 *HRC* on the gripping portions. Gripping surface of the jaws shall be accurately ground. The body of the chuck at the pilot hole and front chamfer, gear teeth of the ring gear and the key shall be hardened to 45 ± 3 *HRC*.

7. General Requirements

7.1 *Engagement of Key with Ring Gear* — For easy and better operation of the gear type chuck, it is necessary that the key pinion shall engage properly with the ring gear.

7.2 *Pilot Holes for Chuck Key* — Pilot holes in the body of the chuck shall lie on common peripheral centre line.

7.2.1 The position of the centre line with reference to the ring gear shall be such that full engagement is assured between teeth of the pinion on the key and teeth on the ring gear.

8. Accuracy

8.1 Each chuck conforming to this standard shall be capable of passing the test described in 8.2.

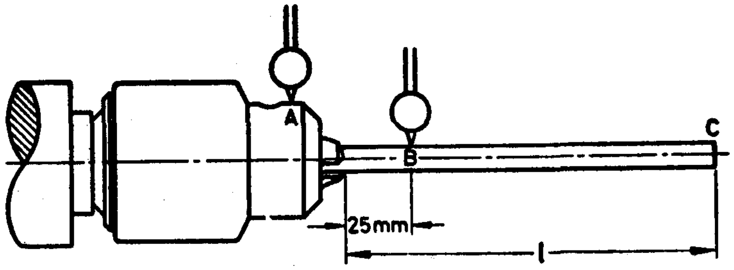
8.1.1 Except for chucks of nominal size 4, two cylindrical test mandrels of a suitable length shall be used for each chuck, one having a diameter nominally equal to the maximum rated capacity of the chuck and the other a diameter nominally equal to half of that capacity. For chucks of nominal size 4, one test mandrel only shall be used, with a diameter nominally equal to the maximum rated capacity of the chuck.

8.1.2 The tolerance on the cylindricity of each test mandrel shall be 0·000 1 × *L*, where *L* is the length of the test mandrel.

Note 1 — The cylindrical surface of test mandrel shall have a surface texture of Ra-0·2 μm.

Note 2 — The cylindrical surface of test mandrel shall have a hardness value in the range 60 to 62 *HRC*.

8.2 *Test Procedure* — The chuck shall be mounted firmly on an accurate test spindle. Each test mandrel in turn shall be fully inserted in the chuck and the chuck shall be tightened by hand, the key, if applicable, being applied to each of the three keyholes. The test mandrel shall not be otherwise supported. The chuck shall be rotated and the readings on the dial gauge noted. The dial gauge reading shall not exceed the total indicator reading given in the table below:



All dimensions in millimetres.

Nominal Size	Permissible Eccentricity (Total Indicator Reading)						
	At *A*		At *B*		At *C*		
	Type L	Types H and S	Type L	Types H and S	*l*	Total Indicator Reading	
						Type L	Types H and S
4	0·10	0·05	0·13	0·10	50	0·17	0·14
6	0·10	0·05	0·13	0·10	75	0·20	0·18
8	0·10	0·05	0·13	0·10	75	0·20	0·18
10	0·10	0·05	0·13	0·10	100	0·24	0·21
13	0·10	0·05	0·13	0·10	125	0·28	0·25
16	0·10	0·05	0·13	0·10	150	0·32	0·29
20	0·10	0·05	0·13	0·10	150	0·32	0·29

9. Torque Ratings

9.1 Chucks conforming to this standard shall be capable of transmitting to the test mandrel specified in 8.2 not less than the torque indicated for its maximum rated capacity in Fig. 4.

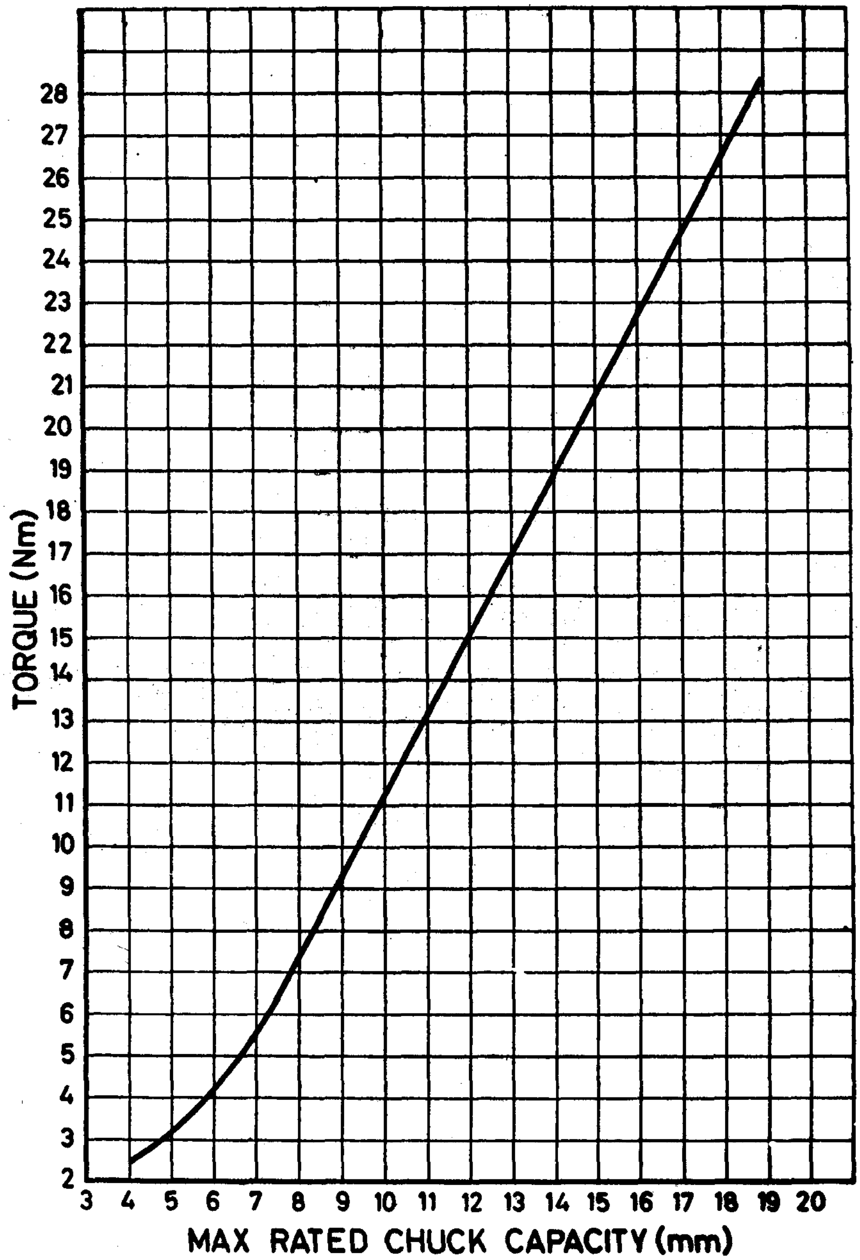


FIG. 4 MINIMUM TORQUE TRANSMITTED

9.2 When this test is performed on a key-operated chuck, the chuck shall be firmly tightened by hand, the key being applied to each of the three keyholes.

10. Marking

10.1 Chucks shall be marked with the manufacturer's name or his registered trade-mark, type and the nominal size.

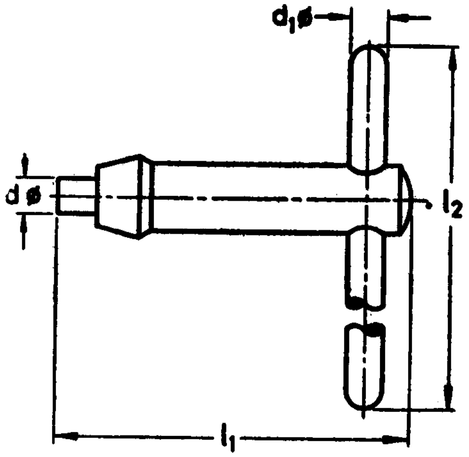
11. *Certification Marking* — Details available with the Bureau of Indian Standards.

12. Packing — Chuck shall be suitably packed in moisture proof containers.

APPENDIX A

(*Clause* 4.1.1)

OVERALL DIMENSIONS OF DRILL CHUCK KEY



All dimensions in millimetres.

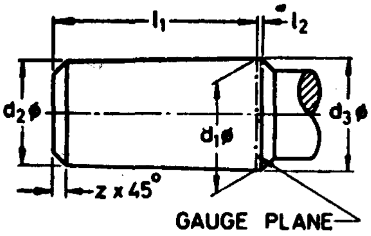
Nominal Size of Drill Chuck	d e8	d_1	l_1	l_2
4	3·9	4·8	35	60
6				
4	5·5	4·8	35	70
6				
8	6·0	7·9	45	70
10	6·3	7·9	45	70
13	7·9	9·5	55	100
16				
20	9·5	9·5	55	130

APPENDIX B

(*Note under Clause* 4.3)

DIMENSIONS OF SPINDLE ENDS

B-1. Short Morse Taper Shanks on Spindle Ends



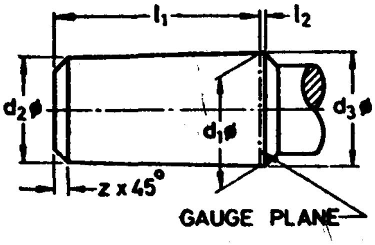
All dimensions in millimetres.

Designation of Taper	d_1 k9	d_2*†	d_3*	l_1	l_2	z	Taper	
							Morse Taper	On diameter
B10	10·094	9·370	10·13	14·5	0·8	1·0	1	0·049 88
B12	12·065	11·143	12·12	18·5	0·8	1·0		
B16	15·733	14·534	15·77	24·0	0·8	1·5	2	0·049 95
B18	17·780	16·182	17·83	32·0	0·8	1·5		
B22	21·793	19·761	21·84	40·5	0·8	2·0	3	0·050 20
B24	23·825	21·300	23·87	50·5	0·8	2·0		

*Calculated values of d_2 and d_3 are given for information.

†The diameter of the small end of the taper shank d_2 is that calculated before chamfering.

B-2. Jacobs Taper Shanks on Spindle Ends



All dimensions in millimetres.

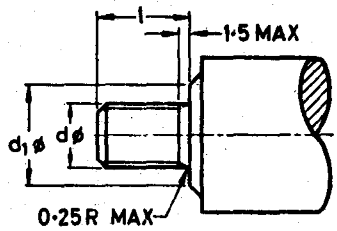
Jacobs Taper No.	d_1 k9	d_2*†	d_3*	l_1	l_2	z	Taper on Diameter
0	6·350	5·802	6·39	11·11	0·8	0·5	0·049 28
1	9·754	8·469	9·82	16·67	0·8	1·0	0·077 09
2 short	13·940	12·386	14·00	19·05	0·8	1·0	0·081 55
2	14·199	12·386	14·26	22·22	0·8	1·0	0·081 55
33	15·850	14·237	15·90	25·40	0·8	1·5	0·063 49
6	17·170	15·852	17·21	25·40	0·8	1·5	0·051 91
3	20·599	18·951	20·64	30·96	0·8	2·0	0·053 25
4‡	28·550	26·346	28·59	42·07	0·8	2·5	0·052 40
5‡	35·890	33·422	35·93	47·62	0·8	3·0	0·051 83

*Calculated values of d_2 and d_3 are given for information.

†The diameter of the small end of the taper shank d_2 is that calculated before chamfering.

‡Details of Jacobs No. 4 and 5 tapers are given for information but these tapers shall be avoided wherever possible.

B-3. External Thread on Spindle Ends

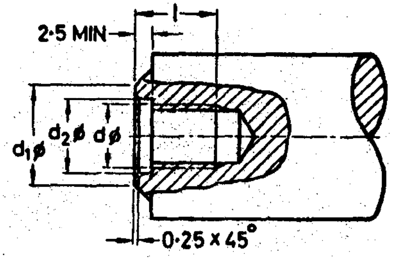


All dimensions in millimetres.

d	$d_1\ ^{+0}_{-0\cdot4}$	l *Max*
M10 × 1	16	14·5
M12 × 1·25	22	14·5
M14 × 1·5	30	18·5
M18 × 1·5	33	18·5

Note — The abutment face on spindle end shall be flat to concave within 0·04 mm across the diameter d_1 and shall be square to the axis of the threads.

B-4. Internal Thread in Spindle Ends



All dimensions in millimetres.

d	$d_1\ ^{+0}_{-0\cdot4}$	d_2	l *Min*
M10 × 1	16	12	12·5
M12 × 1·25	22	14	15·5

Note 1 — The abutment face on spindle end shall be flat to concave within 0·04 mm across the diameter d_1 and shall be square to the axis of the threads.

Note 2 — The counterbore d_2 in the spindle end is intended for clearance purposes only and shall not be used as a register.

EXPLANATORY NOTE

This revision is made more comprehensive and includes gear type drill chucks and self-tightening (keyless) drill chucks having mounting details of Morse taper, Jacobs taper or threaded mounting. Accuracy requirements have been revised and torque rating test has been included.

As in earlier edition, no reference is made to the static balancing of drill chucks, since they are machined all over and few are imbalanced to an extent that could be detected in a static test. The dynamic balance of these chucks is, however, important and a rotational accuracy test is specified for the chuck body as some safeguard against the production of chucks so imbalanced as to be unsuitable or unsafe at normal speeds. Additional safeguards will be necessary with chucks for use at the higher speeds coming into use.

Chucks with short Morse taper bores and chucks with Jacobs taper bores are conventionally interchangeable respectively with the Morse, and Jacobs drill chuck tapers of ISO/R 239-1961 ' Drill chuck tapers '.

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AMENDMENT NO. 1 DECEMBER 1977
TO
IS : 2243-1971 SPECIFICATION FOR DRILL CHUCKS

(First Revision)

Alteration

(*Page* 4, *clause* **4.3.1**, *Table, values under* l_1) — Substitute the following for the existing values:

l_1
14·5 18·5
24·0 32·0
40·5 50·5

Addenda

(*Page* 3, *clause* **4.1**) — Add the following sentence at the end of 'Note' given in the table:

'For related mounting details of chucks, *see* Appendix C.'

(*Page* 4, *clause* **4.2**) — Add the following sentence at the end of 'Note' given in the table:

'For related mounting details of chucks, *see* Appendix C.'

(*Page* 11, *clause* **B-4**) — Add the following Appendix C after **B-4**.

APPENDIX C

(Note under Clauses 4.1 and 4.2)

TYPICAL CHUCK CAPACITIES BY TYPES AND RELATED MOUNTING DETAILS

Chuck Type	**Capacity**	**Short Morse Taper Mounts***						**Jacobs Taper Mounts†**									**Internal Threaded Mounts‡**				**External Threaded Mounts§**	
		B 10	**B 12**	**B 16**	**B 18**	**B 22**	**B 24**	**0**	**1**	**2 Short**	**2**	**33**	**6**	**3**	**4**	**5**	**M 10 × 1**	**M 12 × 1·25**	**M 14 × 1·5**	**M 18 × 1·5**	**M 10 × 1**	**M 12 × 1·25**
Type L — Guided 3-jaw light duty chuck	0 — 4																					
	0 — 6·5	O							O								P				P	
	0 — 8	O							O								P				P	
	1·5 — 10		O						O								P				P	
	1·5 — 13		O														P	P			P	
	3 — 16			O						O		O	O					P				
Type H — Guided 3-jaw industrial or heavy duty chuck	0 — 4																					
	0 — 6·5		P							P							P	P				
	0 — 8		P							P							P	P				
	1·5 — 10			P							P							P				
	2 — 13			P									P						P	O		
	3 — 16				P									P					P	O		
	5 — 20				O	P								P					O	P		
Type S — Guided 3-jaw industrial self tightening (key less) chuck	0 — 4	P							P													
	0 — 6	P	P						P								P	O				
	0 — 8		P							P							O	P				
	0 — 10			P							P							P	O			
	0·8 — 13			P									P						P			
	3 — 16				P								P						P			

**See* clause 4.3.1.
†*See* clause 4.3.2.
‡*See* clause 4.3.3.
§*See* clause 4.3.4.

Note — P : Preferred mount.
O : Non-preferred mount. Other mounts can be obtained by special arrangements.

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AMENDMENT NO. 2 JANUARY 1986

TO

IS:2243-1971 SPECIFICATION FOR DRILL CHUCKS

(First Revision)

(*Page 5, clause 4.3.2, table, last column line 1*) - Substitute '0.049 29' *for* '0.049 28'.

(*Page 6, clause 6, last line*) - Delete the words 'front chamfer' and add the following sentence at the end of the clause:

'However hardening of the front body chamfer of the chucks shall be at the discretion of the manufacturer.'

(*Page 7, clause 8.2, Table*) - Add the following note at the end of the table:

'Note - For checking the accuracy for half capacity size for a particular nominal size of chuck, the length *l* for the test mandral shall be as specified or closer to the half nominal size of the chuck.'

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TO

IS : 2243 - 1971 SPECIFICATION FOR DRILL CHUCKS

(First Revision)

(*Page* 8, *clause* **9.1**) — Add the following new clause after **9.1**:

'**9.1.1** The procedure for testing the torque rating of drill chucks shall be adopted as under:

Fit the chuck on its appropriate shank. Insert the test mandrel in the chuck so as to abut against the chuck body and then pull it out by about 2 mm. The test mandrel is gripped by the jaws; tightening with one hand applying the key to each of the three holes. The test mandrel is subjected to a twisting moment given in Fig 4. The test mandrel shall not turn in the chuck and neither should the chuck twist/become loose in its shank.

NOTE 1 — The diameter of the test mandrel should be approximately equal to the maximum capacity of the drill chuck.

NOTE 2 — The torsional movement should be applied at a distance approximately equal to '*l*' as shown in **8.2**.

(*Page* 8, *clause* **9.2**) — Delete.

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